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APPLICATION OF SINGLE POINT AND 2-D IMAGING RAMAN SPECTROSCOPY TO CHEMICAL CHARACTERIZATION OF THE HANFORD UNDERGROUND STORAGE TANKS.

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The characterization of the chemical composition of the waste matrices of the Hanford Underground Storage tanks is a particularly challenging problem given the extreme physical and chemical heterogeneity of the tank contents. Currently, chemical characterization is performed by drilling core samples from the tank salt cakes, which are then taken into a hotcell, homogenized, and sent out for wet chemical analysis. Raman spectroscopy has been proposed as a alternative method of chemical analysis, yielding real-time information on the molecular make-up of both hot cell core samples and in situ tank materials with retention of spatial or depth information. Two near Infrared Raman spectroscopic systems under development will be described. The first is based on fiber optic probes for the single point of contact analysis of tank materials. The probes can be deployed in the hot cell or as part of an in-tank cone penetrometer for direct chemical depth profiling of the waste matrix. The second system is a scanning, imaging remote Raman spectrometer for the chemical characterization of surfaces. A scanning laser line is used in conjunction with imaging optics and a 2-D CCD array camera to build a chemical map of a surface without physical contact with the sample surface. The system is currently being designed for the rapid survey of hot cell core samples, but may potentially be expanded to include tank surface chemical profiling. Limits of detection for each system will be presented, as well as performance of each system as a function of sample distance from the probe optics, ambient lighting, interfering signal from background Raman and fluorescence, and signal to noise.

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